MADRAS FISHERIES DEPARTMENT

ADMINISTRATION REPORT

FOR THE YEAR

1917-18

BY

SIR F. A. NICHOLSON, K.C.I.E.
Honorary Director of Fisheries

Report No. VII of 1917
Madras Fisheries Bulletin, Vol. XI, pages 173 to 207

MADRAS
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

PRICE, 8 *annas.* 1931

AGENTS FOR THE SALE OF MADRAS GOVERNMENT PUBLICATIONS.

IN INDIA.

The Superintendent, Nazair Kanun Hind Press, Allahabad.

M. C. Kothari, Bookseller, Publisher and Newspaper Agent, Raopur Road, Baroda.

R. Sunder Pandurang, Kalbadevi Road, Bombay.

D. B. Taraporevala Sons & Co., Bombay.

Thacker & Co. (Ltd.), Bombay.

N. S. Wagle, Circulating Agent and Bookseller, No. 6, Tribhuvan Road, Girgaon, Bombay.

The Burma Book Club (Ltd.), 240-A, Merchant Street, Rangoon, Burma.

The Book Company, Calcutta.

Butterworth & Co. (Ltd.), 6, Hastings Street, Calcutta.

R. Cambray & Co., Calcutta.

Thacker, Spink & Co., 3, Esplanade East, Calcutta.

Shri Shankar Karnataka Pustaka Bhandara, Malamaddi, Dharwar.

Ramakrishna & Sons, Lahore.

The Upper India Publishing House (Ltd.), Lucknow.

The Christian Literature Society for India, Post Box No. 501, Park Town, Madras.

City Book Company, Post Box No. 283, Madras.

Higginbothams (Ltd.), Mount Road, Madras.

The Law Book Depot (Ltd.), 15 and 16, Francis Joseph Street, Madras.

S. Murthy & Co., Madras.

G. A. Natesan & Co., Madras.

P. R. Rama Iyer & Co., Madras.

P. Varadachari & Co., Booksellers, 8, Lingha Chetti Street, Madras.

S. Vas & Co., Madras.

The Theosophical Publishing House, Adyar (Madras).

The Universal Publishing Co., Bezwada (Madras).

E. M. Gopalakrishna Kone, Pudumantapam, Madura (Madras)

The Modern Stores, Salem (Madras).

The Srivilliputtur Co-operative Trading Union (Ltd.), Srivilliputtur (Madras).

S. Krishnaswami & Co., Teppakulam Post, Trichinopoly Fort (Madras).

Nivasarkar, Manager, "Hitawada," Nagpur.

The Booklovers' Resort, Booksellers and News Agents, Taikad, Trivandrum.

IN STRAITS SETTLEMENTS.

The Federal Rubber Stamp Co., Penang.

NOTICE.

Official publications may be obtained in the United Kingdom either direct from the office of the High Commissioner for India, India House, Aldwych, London, W.C. 2, or through any bookseller.

MADRAS FISHERIES DEPARTMENT

ADMINISTRATION REPORT

FOR THE YEAR

1917-18

BY

SIR F. A. NICHOLSON, K.C.I.E.

Honorary Director of Fisheries

Report No. VII of 1917

Madras Fisheries Bulletin, Vol. XI, pages 173 to 207

MADRAS

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

1931

CONTENTS

	PAGE
I. Staff	173
II. Distribution of work	173
1. Director's branch—	
(*a*) Oil and guano operations	175
(*b*) Inshore fishing experiments	175
(*c*) Socio-economic work	176
(*d*) Temperance	177
(*e*) Education	177
(*f*) Miscellaneous	179
(*g*) Finance	179
III. Report of the Marine Biologist—	
i. Financial results	183
ii. The Tinnevelly Chank Fishery	184
iii. Recruitment	184
iv. The Ramnad Chank Fishery	184
v. Acquisition of land sites	185
vi. Tirupalakudi Chank Fishery	185
vii. Chank Fishery in Ceylon	186
viii. New chank contracts	187
ix. Beche-de-mer industry	187
x. Pearl fishery	188
xi. Tuticorin fish farm	188
xii. Pulicat oyster park	189
xiii. Zoological specimen supply	189
xiv. Research	190
xv. Deputation to Baroda	191
xvi. Socio-economic work	191
xvii. Loans for the purchase of boats	191
xviii. Temperance work	192
xix. Recruitment for the Overseas Forces	192
IV. Report of work done in the Piscicultural Branch—	
i. Staff	193
ii. Tours	193
iii. Sunkesula fish farm	193
iv. Pudur scheme	193

Marine Biologist's branch (*Mr. James Hornell, F.L.S.*).—The Tuticorin fish-farm, the edible oyster farm at Pulicat, the preparation of marine zoological specimens for educational work, beche-de-mer preparation, scientific and practical investigations, and the writing of bulletins.

Pearl and chank branch (*Mr. James Hornell, F.L. S.*).—Pearl and chank work over the whole coast from Madras to Cape Comorin, and miscellaneous.

Pisciculturist's branch (*Messrs. V. Govindan, B.A., F.Z.S., and B. Sundara Raj, M.A.*).—The Sunkesula fish-farm, that at Ippur, larvicidal work, the breeding of fish new to inland waters, such as gourami, etroplus, tench, the stocking of tanks, the conservancy of various waters, the beginnings of a very detailed and systematic survey of the waters of the Presidency in view to systematic stocking and culture, the preparation of several distinct schemes such as the piscicultural utilization of the great new irrigation reservoir at Mopad, the cultural and sanitary development of the Chingleput Fort moat, and a similar scheme at Vellore Fort, and the beginnings of investigation into the better fishing of deep water and quasi-permanent tanks in the Presidency. During the year the soap works were separated from "Fisheries" and handed over to "Industries," remaining however for the present under the general supervision of the Honorary Director in his individual capacity and not as the Honorary Director of Fisheries.

5. *Director's branch.*—Technical work at Tanur and the Cannery proceeded on normal lines, and there is nothing to need special mention; cannery operations were somewhat larger than in the previous year but quite insufficient for the general demand, and the net profit, as shown below, considerably greater. The motor sea-going launch "Leverett," built and engined by Messrs. Brunton of Cochin and an excellent boat, was delivered towards the close of the canning season and was then sent to Tuticorin, where she was of great service and effected considerable economy in towing chank canoes. The work of the fishing machwas (Ratnagiri pattern boats) belonging to the department was very unsatisfactory, and will have to be reorganized.

A scheme for the refrigeration of cheap shoal fish (sardines, mackerel, catfish, etc.), was elaborated and freezing tanks have been built at Tanur; the scheme, which is purely experimental, will be put in operation at once. The idea is to see whether

operating on cheap but good fish, fresh fish can be successfully placed in distant markets by sharp freezing in ice and salt, and in an extended zone of adjacent markets by simple chilling.

6. *Oil and guano operations.*—As reported in previous years there are some 253 private oil and guano factories on the West Coast, which have sprung up since and in consequence of the department's operations in 1908-09. Owing to the war and consequent absence of freight, and in part also to short distribution and lessened fat contents in the fish, many of the factories, especially in Malabar, have had very bad times either from want of products or from inability to sell them. The absence of freight led to such cessation of sale that where products were fairly abundant, guano, ordinarily priced at Rs. 70 per ton was unsaleable at Rs. 30, and oil ordinarily worth Rs. 150 was unsaleable at Rs. 40. Fortunately, the Controller of Munitions made requisitions upon the Department for oil for military purposes, and this, coupled with a sudden demand by the jute mills, brought prices back to normal and greatly benefited the industry ; this Department supplied about 50,000 gallons of oil. Not only so, but since certain Military departments require superior oil, the manufacturers were in many cases induced to prepare and supply these better qualities, and under direct departmental instruction and stimulation, have produced and can produce very superior oil even beyond the requirements of the customers. This matter is now being followed up.

7. As regards guano this department, through Mr. V. Govindan, stimulated the formation of groups of producers, and acting as intermediary with large customers obtained sales to a considerable amount which have sent up the prices to normal. It is hoped to make these groups permanent and bind them in a completer union by forming them into co-operative societies. Doctor Anstead, Deputy Director of Agriculture for Planting Districts has earnestly pressed upon me the need for bringing producer and planter into direct touch, and the matter will be specially dealt with during the coming season.

8. *Inshore fishing experiments, Madras.*—On the initiative of Mr. V. Govindan who also took charge of the matter, a very useful experiment was made in bringing two West Coast canoes, nets, and 14 men over to Madras to fish Madras waters with the harbour (by special permission) as base. The experiment was for a year and

began in June 1917 and lasted till June 1918. It was then closed by the Honorary Director, perhaps prematurely, and Government have now been moved to sanction a revival of operations on a three-year term and on a wider basis. For though the experiment, like most novel experiments, did not fully pay for itself yet (1) a large amount (53,000 lb.) of fish was caught, some under circumstances when catamarans could do nothing in the way of capture of valuable shoal fish for which the agile Malabar canoes and large nets are specially fitted; (2) it was the cost of bringing over the boats and men, the very high pay, rations, and house-rent necessarily given to induce West Coast men to come to Madras and remain away from their families, and a considerable sickness of the crews due to the unaccustomed "water" of Madras, that prevented full financial success. With wages charged at Madras rates, that is such as would be payable to local men hired by local enterprise there would have been substantial profit. Hence and because the experiment created local interest (though at first regarded and treated with hostility) a more thorough testing of the experiment is desirable, local crews being recruited if possible, and other boats, nets, lines, and methods tried. The experiment cost, all told, Rs. 4,406-6-11, and the fish caught realized Rs. 3,044-12-0.

9. *Socio-economic work.*—Mr. V. Govindan, as usual, has been busy in stimulating progress, and has visited in his propaganda, most of the important villages on the coast, some of them several times. At the beginning of the year there were, in existence on the West Coast, seven credit societies all based on thrift: during the year three credit and one productive society were registered, while, eight credit societies and one productive society applied for registration. Of the three new credit societies one opened at Rayapuram (Madras), being the first started on the East Coast by direct departmental work. Three are reported by Mr. Hornell to have been opened among fishermen on the Ramnad coast by the Registrar for co-operation. Of the productive societies one has been formed by oil and guano producers in the Mangalore taluk, and it is hoped that its formation will lead not only to increased production and better sales, but to better classes of goods, since, like the Japanese guilds, the society will refuse products not up to standard. The other productive society waiting registration, is that at Thalayi, and is to be a society of curers which Government is aiding [G.O. No. 742, Financial (Separate Revenue), dated 4th September 1917].

10. The nine societies at work (exclusive of Rayapuram for which figures are not available) had, on 30th June 1918, 884 members of whom 187 were females, holding 1,103 shares and with "own" funds, actually collected, of Rs. 10,265; loans were issued for Rs. 18,209, of which Rs. 4,058 were for the paying off of prior (often usurious and enslaving) debts.

An encouraging feature of the year's work was that fisherfolk have begun to invite Mr. Govindan to visit the villages and organize societies.

11. In the matter of co-operation in general among the fisherfolk, fairly definite proposals have been made to Government, as read in G.O. No. 2049, Revenue, dated 27th May 1918, in which Government have laid down that the development of the communities is a primary duty of the Department and hope that the spread of co-operative methods among the fisherfolk may be accelerated.

12. *Temperance.*—Two societies continue to do good work and to progress, notwithstanding factious troubles; out-members have been recruited from villages where there were not enough to form independent societies. Mr. Govindan mentions as a reason for intemperance additional to those formerly adduced, that the fishermen's cults require offerings of drink to their deities and that consequently what is good for gods cannot be bad for men, a belief which has classical warrant but does not excuse or explain the intemperance of Christian fishermen as so often mentioned by Mr. Hornell. There is much to be done in this way, and Mr. Hornell mentions the good effect of coffee and tea shops for the men employed in his branch of work. On many parts of the West Coast tea and warm drinks (temperance) are sold on the beach or close by, to the fishermen so that the idea, being in indigenous practice may be spread by a diligent propaganda and practical example. I have been favoured with an important letter from the Board of Revenue (Salt and Abkāri) desiring to enlist our aid in the provision of "coffee shops" in place of toddy shops, a philanthropic suggestion of the highest importance and interest.

13. *Education.*—Not much new work has been done, but in the papers read in G.O. No. 2048, Revenue, dated 27th May 1918, general proposals have been made and concurred in by the Director of Public Instruction (the Hon'ble Mr. Stone) whose sympathy with the proposals is of the highest value. Government have generally accepted the suggestions and have ordered definite proposals, which are now occupying attention. It is quite certain that the

people themselves are beginning to wake up to the need for education, and that it will be welcomed, especially in the somewhat wide form which has been suggested, both on literary, technical, practical, and social lines.

14. *Mr. Hornell's work.*—As Mr. Hornell's report both as Marine Biologist and as Superintendent of Pearl and Chank Fisheries, is printed almost in full, repetition here is needless. Owing to financial exigencies the projected Krusadai Pearl Oyster Farm, where pearls are to be "induced" and grown under complete control has had to be postponed "for the duration"; the biological station and new aquarium at Madras with headquarters therein for fisheries, has similarly been postponed, and still more regrettably, the exploration of the deep sea by a special vessel.

The chank fishery yielded good results and profits, though the number of shells fished was much smaller than expected, owing to various reasons. A trial expedition to fish the Ceylon chank beds which are free to all comers resulted favourably, and is being repeated. Statement I annexed to this report gives an abstract of expenditure and receipts in the Marine branch and Statement III gives details for the chank fisheries. For further details the report may be consulted.

15. *Inland waters.*—Similarly the pisciculturist's report is printed almost in full.

It may be noted that the gourami obtained from Mauritius and Java have now bred successfully, so that a considerable stock of these very valuable food fish is in hand; so also of Etroplus; the tench introduced from the Nilgiris have not yet bred.

Certain important items are briefly mentioned in paragraph 4 supra; more details will be found in the report.

An important experiment in fishing deep water tanks was at last initiated. In this Presidency, the irrigation tanks in general are exhausted of water in a few months when, of course, all fish in the tanks would perish except those which, like murrel, aestivate deep down in the mud. Hence the universal method of fishing is to await the fall of the water almost to exhaustion when, by a general battue, practically all the fish are captured. But if the tank is deep and contains permanent water or obtains supplies which keep up the level for a year or so, the tank remains unfished for want of any fishing material or method; in other words, precisely when conditions are favourable for the growth of a large head of fish, such fish are left uncaptured, so that the food supply

obtained is a minimum and the rentals fall to nil. There is a good number of such tanks, and experiments were made to ascertain the best methods of fishing them; boats, nets, and men were engaged and our own staff supervised operations, which, however, have not yet been concluded; unexpected difficulties cropped up, e.g., in the way of weeds, the opposition of persons interested in keeping off outsiders, and so on, but it is obvious that on tanks which, like some of the Sangam tanks, Mopad, etc., contain large bodies of water permanent or practically so, common sense methods must eventually succeed. Statements I and I (*a*) give an abstract and details respectively of expenditure and receipts in this branch.

16. *Miscellaneous.*—It was found impossible to take over from the Salt department any of the fish-curing yards for direct departmental control, as sanctioned by G.O. No. 752, dated 10th September 1917; that will be a main item of work in 1918-19.

Bulletins Nos. 10 and 11 were published, the former containing annual reports, 1908—1917 (pages 179), and the latter containing the Madras Fishery Investigations, 1917 (pages 172).

The department exhibited at the Madras Exhibition of Industries, 1917-18, and was awarded a gold medal and diploma of excellence for canned and cured fish.

There were several useful inquiries from outside during the year; one by the Hon'ble Mr. Godbole of the Bombay Legislative Council regarding oil and guano factories; on my reply a council resolution in favour of further inquiry and support of such factories was accepted by Government subject to the report of the Industries Commission; Mr. Mead, I.C.S., Director of Industries, Bombay, also investigated our fishery and soap industries, and in June Mr. Christie, I.C.S., of Burma was placed on special duty by his Government for a similar inquiry now proceeding, in view to the establishment of similar work in Burma.

17. *Finance.*—By G.O. No. 2614, Revenue, dated 11th July 1918, receipts and charges are to be classified under five heads, viz.:—

I. Supervision and research;
II. Marine fisheries;
III. Inland fisheries;
IV. A. Factories,
B. Vessels;
V. Capital expenditure;

in view to ascertain "the profit or loss under head of work".

By this Government Order while the main portion of all salaries, establishment allowances, travelling allowance and contingencies, is debited to "I. Supervision and Research" a considerable portion (one half in the factories) is debited to the specific operations on which the staff are employed. This conveniently distributes the total cost of the staff so that while an equitable amount is debited to quasi commercial work (i.e., factories), that due to "Experiment and Research", which necessarily bulks large in such a department, is debited accordingly. Similarly with regard to IV-B. "Vessels", the total running cost of the boats owned by the department (other than the "Lady Nicholson" and other boats of the pearl and chank branch) is debited to "Vessels", and anything earned by them, e.g., in supplying fish to the cannery and to Tanur, is credited to that head. Pearl and chank fisheries are now included under "II. Marine Fisheries" instead of forming a separate head of account and report.

18. Statement I in the appendix gives in one view an abstract under all five heads, and shows that on tallying current expenditure (Rs. 2,20,049) with income (Rs. 2,26,230) there is a net credit balance of Rs. 6,180. Considering that a sum of Rs. 59,100 forms the expenditure on "Supervision and Research" plus a considerable proportion of salaries, etc., debited to and entered under the other heads, the result is very satisfactory and is due to the net profits on chanks, fishery rentals, and experimental factory operations, such net profits being almost entirely due to departmental work in the initiation or development of resources and operations.

Moreover when comparing expenditure and receipts it should be noted that whereas the heavy amount under item I is for fifteen months, receipts such as rentals whether of chanks or of inland waters, are mainly for one year only, so that item I which is wholly an item of expenditure, is disproportionately heavy when compared with receipt; the credit balance would be still greater if item I were taken for twelve months only.

19. It should be noted, however, that the actual cash outlay of the year was Rs. 2,42,478, or Rs. 22,429 larger than that entered (Rs. 2,20,049) as current expenditure; this mostly represents capital expenditure (Rs. 19,399) of which, by Government Order only 10 per cent is entered (being depreciation) as *current* expenditure; hence Rs. 1,939 are entered under current account instead of Rs. 19,399. The capital expenditure is given in detail in the first column of Statement I (*a*) and includes Rs. 3,750 for a motor-car,

subsequently however resold for Rs. 3,800 (not yet collected and therefore not included in "receipts"), Rs. 7,821 as the total cost of the motor launch "Leverett", and Rs. 3,560 for new sheds and plant at the cannery. Capital outlay, minus depreciation, remains of course as an asset, and merely represents the transmutation of cash into property.

20. Statements I (*a*) and I (*b*) give details under the several heads. Statement II is the list, ordered by Government, showing tanks at present stocked and leased by the department. Statement III gives the result of the chank fisheries for the year.

21. Statement IV gives the trading and profit and loss accounts for the cannery. The expenditure side in these accounts differs from that in Statement I which only shows drawings from the treasury, whereas Statement IV gives on one side the expenditure cash and of materials from stock, and on the other the receipts inclusive of stock in hand (taken at cost price) at the close of the year. This of course is the usual manufacturing method and gives a true account of results. The profit and loss account shows a net profit of Rs. 8,151 on cannery operations after deducting all charges for staff, operations, depreciation and interest.

22. Statement V is similar for Tanur and shows a net loss of Rs. 997. This is due to the small output of a factory carrying on a series of comparatively small operations, which though technically and commercially successful, were insufficiently large to cover the disproportionate cost of establishment. Moreover the year in Malabar was very bad for oil and guano operations; a few extra tons of fat sardines would have converted the deficit into a profit. The loss is really debitable to research as the factory is mainly experimental.

23. Notwithstanding then the heavy expenditure for "Supervision and Research" and for experimental work, and the fact that these objects cover fifteen months' expenditure as against only twelve months' receipts in certain large items, the departmental balance sheet for 1917-18 is not unsatisfactory. Moreover, in perhaps the current and certainly in subsequent years, the net income should be considerably increased by operations already begun or beginning, such especially as the fishing of existing deep water tanks, e.g., those of the Sangam and Nellore works and the new Mopad reservoir. It is further to be noted that the income of the department is obtained without raising a single anna by

taxation, licences, or other charges on the fishing folk or on the public.

24. Nevertheless I desire here to disclaim any idea either of measuring the success of the department by its balance sheet, or of narrowing its scope and objects by considerations of immediate departmental profit and loss. Its primary object is not revenue but development and progress; revenue is incidental and while welcome as a fiscal contribution and as a fund providing for further expenditure, is not a direct object save as an *evidence* of success in concrete fishery operations. Even as such evidence it is imperfect; e.g., Tanur shows a loss on the whole yard, yet, as stated in paragraph 22, the several curing operations were successful in themselves both technically and commercially, and needed only to be larger to show financial profit; these operations and investigations are the basis of future curing operations throughout the Presidency and, in the matter of fish oil and guano, have already resulted in nine years in 253 private factories and a great and developing industry and trade. The department is one which, for the good of the consuming public in general and of the fishing classes in particular, must be primarily a spending department, spending State funds on well considered plans for improvement and development, and the right questions are, in fact, how money can most usefully be expended, on what objects, and to what extent. The department is mainly concerned with *service*, and the profits sought are not departmental cash profits but the introduction of improvements, the progress and profit of the fisherfolk with the fishing and allied industries, and the economic benefit of the State in general.

ENCLOSURES.

(1)

Letter—from J. HORNELL Esq., F.L.S., Government Marine Biologist and Superintendent, Pearl and Chank Fisheries, Tuticorin.

To—the Honorary Director of Fisheries, Madras.

Dated—Tuticorin, the 2nd/8th June 1918.

I have the honour to submit the following summary of the work done in the Marine section of this department for the year ending 30th June 1918 in respect of the Pearl and Chank Fisheries and for the fourteen months' period ending 31st May 1918 in respect of the other branches of this section. The usual annexures are appended.

2. Operations were carried on upon the same general lines as in the preceding year. No new developments could be taken in hand in consequence of the stagnation of progress due to the effects of the war.

3. *Financial results.*—The year's work has been most satisfactory, especially in that connected with the Chank Fishery. The expenditure, revenue and net profits of the various sections of this industry are as follows:—

——	Expenditure.			Receipts.			Profit.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
(1) Tinnevelly Pearl and Chank Fisheries	19,926	7	0	16,689	13	1	−3,236	9	11
(2) Ramnad Chank and Beche-de-mer Fisheries	28,813	3	7	71,069	5	8	42,256	2	1
(3) Sivaganga Chank Fishery ...	246	13	6	269	13	5	22	15	11
(4) Tanjore Chank Fishery ...	...			4,890	0	0	4,890	0	0
(5) South Arcot Chank Fishery ...	...			900	0	0	900	0	0
(6) Chingleput and Nellore Chank Fisheries	...			600	0	0	600	0	0
(7) Ceylon Chank Fishery... ...	3,029	5	5	4,577	6	3	1,548	0	10
Grand total ...	52,015	13	6	98,996	6	5	46,980	8	11 or

Rupees 39,278-5-9 deducting supervision charges, viz., Rs. 7,702-3-2.

4. For the purpose of comparison with figures given last year, the total net profit should be taken as Rs. 57,121–12–9, excluding the charges under "Pearl Fisheries" such as maintenance of the Motor Inspection Schooner "Lady Nicholson," etc., as the same were not included last year. This total net profit compares satisfactorily with that for the preceding year, Rs. 53,247–4–8 as the substantial increase of Rs. 3,874–8–1 has been made. The chief advance is in the Ramnad fishery due to an increase in the catch of shells, 264,760 in 1917–18 as against 254,221 in 1916–17.

5. The financial aspect of the minor branches of semi-commercial work is shown as under:—

	Expenditure.			Receipts.			Profit.			
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	
Marine Fish farm ...	684	6	7	1,496	7	0	812	0	5	
Pulicat Oyster farm.	1,124	5	9	843	6	6	280	15	3	(Loss)
Zoological supply ...	302	11	11	735	11	0	432	15	1	
Total	2,111	8	3	3,075	8	6	964	0	3	

All these items compare satisfactorily with those of last year and show an increase, but comparison is difficult as these figures are for fourteen months as against twelve months of last report.

6. *The Tinnevelly Chank Fishery.*--The total number of shells paid for was 126,377 excluding 240 Idintakarai chanks which remain unsold as compared with 163,527 in 1916–17. Quality was again most excellent and these shells well maintain their reputation as the first in all round size and quality yielded by any fishery in India and Ceylon. The drop in yield was in great part due directly to the unfavourable nature of the weather from the beginning of January till the middle of March; the adverse factor was unusually strong and chilly winds, which rendered regular work difficult and unpleasant. Had it not been that the weather during November and December (1917) was milder than usual, the result would have been disastrous. In some as yet not understood way the weather conditions also affected adversely the worms which constitute the food of the chank, causing a scarcity on many of the beds. This in turn resulted in the scattering of the chanks in search of food instead of the usual concentration wherever the worms abound.

The men had poor earnings over the season as a whole, and this has had a very discouraging effect upon their *morale.* Every step was taken by means of towage and camping facilities, payment of batta on days of very small catches, and the like, to hearten them and induce them to preserve. The number of divers employed was rather better than in the preceding year at the commencement, but the poor earnings in February and March caused a serious diminution which in turn adversely affected the catches. For the greater part of the time six crews only worked regularly.

Recruitment.—Four Arab divers were recruited in Ceylon; one died of acute diarrhœa a few weeks after arrival and of the remaining three, two were so discouraged with their poor earnings that they requested permission to transfer to Rameswaram, which was allowed.

7. *The Ramnad Chank Fishery.*—The good results here compensated amply for the poor harvest of the Tinnevelly beds. The total of full-sized shells fished at the various centres last year and in the preceding year were as follows :—

	1916–17.	1917–18.
Rameswaram	158,942	192,252
Kilakarai and South Vedalai ...	16,295	17,295
Pillaimadam, Jadhi quality ...	9,175	22,410
Do. Patti do. ...	...	3,851
Tirupalakudi	69,809	28,952
Total ...	254,221	264,760

8. Work in the Vedalai and Rameswaram sections was particularly remunerative and demonstrated once more how the divers working in

Ramnad district appreciate the facilities and help given to them. Prior to the beginning of the Rameswaram fishery at the end of February, I had considerable misgiving as to the adequacy of the labour force available, as the merchants who work the Ceylon fisheries desired to take the divers to Ceylon at an early date. The men were themselves anxious to join our fishery and eventually after protracted negotiation with the leading divers, an arrangement was made whereby a larger number than was the case last year, pledged themselves to work in the Government fishery. This satisfactory outcome assured the success of the fishery from the beginning and I now hope that the custom of taking part in the Rameswaram fishery before going to Ceylon, has become an established one. It is however only because the facilities we give are superior to those which obtain in Ceylon.

9. The Rameswaram fishery began on 27th February 1918 and lasted till 24th April 1918 when the Muhammadan divers held their Kandiri celebration in the camp prior to dispersing. The services of the motor launches "Pearl" and "Leverett" and of the chartered steam tug "Eider" were invaluable for towing the boats to and from the beds. Last year the charter of the "Eider" cost Rs. 3,600; this year, by having the use of the "Leverett" we were able to shorten the period of charter considerably so that the bill for her use was reduced to Rs. 3,000 in spite of increase in the rate of hire. The "Leverett" though small is very powerful for her size and was able to tow at a fair speed as many as 36 boats in ordinary weather.

10. *Acquisition of land sites.*—In order to erect further permanent buildings at the various chank centres in Ramnad district, a site for a beche-de-mer factory, store and office was acquired at Tirupalakudi, the extent being 42·4 cents and the cost Rs. 289–1–6. The Government Order sanctioning the acquisition is No. 137, Revenue, dated 18th January 1917. In addition, by the sanction conveyed in G.O. No. 552, Revenue, dated 6th September 1917, G.O. No. 716, Revenue, dated 27th November 1917, a small site of 4 cents was acquired for Rs. 2–4–0 at South Vedalai and another of 74½ cents for Rs. 199–10–8 at Olakkuda, Rameswaram, respectively. The former is for the erection thereon of a chank godown, the latter for a second set of divers' lines.

11. *Tirupalakudi.*—At this centre work was hampered till late in the season by strong winds which made the sea too muddy for effective operations. This section of the coast is the most unfavourably situated of any in regard to this factor: only in exceptional seasons is the weather sufficiently good to permit of large quantities of shells being fished, and here as at Tuticorin, the weather was almost uniformly adverse throughout

the year, aggravated by unseasonable and heavy rains in August, which caused floods of muddy water to pour into the sea at a time when normally the water should be clear. The quality of the shells is poor and of low market value, hence it is difficult to give the divers a rate which will adequately remunerate them. Only by running a beche-de-mer fishery in conjunction, can their earnings be made enough to induce them to carry on the chank fishery. Without the help of the subsidiary industry named the men could not be prevented from abandoning the chank fishery in favour of other work.

12. *Chank fishery in Ceylon.*—Partly to prevent the Tuticorin chank divers from drifting away to other employment during the six months when fishing cannot be carried on at Tuticorin (a danger more pressing nowadays than formerly on account of the marked increase in the cost of living since the war began), and partly to gain exact knowledge of the fishing stations and general course of operations in the chank fishery in Ceylon, by sanction of Government (G.O. No. 1435, Revenue, dated 21st May 1917) four crews of divers were sent to participate in the Ceylon fishery during three months ending October 1917.

13. Weather conditions were generally unfavourable and the total catch of the 32 divers amounted to 29,432 full-sized shells only. The cost of these including incidental charges was Rs. 3,029-5-5, the cost of supervision amounted to Rs. 263-13-5, and we add the crew's wages and the upkeep of the launch "Sutherland" sent with the canoes for towage purposes, the total expenditure totalled Rs. 3,926-6-1. The shells were eventually sold by tender at the rate of Rs. 155 per 1,000, the total receipts being Rs. 4,577-6-3. The net profit therefore was Rs. 651-0-2, but it should be remembered that much of the expense charged against these shells was not incurred specifically on this account; the wages of the clerk and peon, and the wages of the "Sutherland's" crew would have had to be met from the department's budget whether this expedition had been sent or not. Hence the real profit is considerably greater than the apparent one. The prices to the divers were regulated by the rates current in Ceylon during the fishery, and averaged one anna five pies per shell.

Our divers were fairly well satisfied as they were able to support themselves and their families through a period when other earnings would have been difficult to make. Had the weather been even moderately favourable, they would have obtained much better results.

14. The quality and size of these Ceylon shells compare most unfavourbly with those from our Ramnad and Tinnevelly fisheries; a very large proportion are so small that if fished on the Madras coast they would be confiscated without payment and as many as possible returned alive to the sea.

15. *New chank contracts.*—During the past year, the produce of the Tinnevelly chank fishery for the three years 1918–19 to 1920–21, inclusive, was offered to public tender. The highest offer was made by Messrs. J. E. Dutt & Sons of Dacca, who have held the contract for the Tinnevelly and the Ramnad shells for several years past. The rate obtained is Rs. 325 per 1,000, which compares most favourably with Rs. 121 received during the past three years. There was considerable competition and all offers were largely in excess of the previous rate.

16. The South Arcot chank lease for a two years' period from 1st April 1918, was also re-let to M.R.Ry. Subbarayalu Chettiyar of Cuddalore at an enhancement of Rs. 600 per annum, from Rs. 900 to Rs. 1,500 per annum. The chank market is now higher than it has been for many years; one of the chief reasons appears to be the difficulty experienced by the bangle manufacturers in getting large sized shells other than those from the Madras coast, in consequence of the gradual decrease in the average size of the shells fished in Ceylon waters, where no size limit is imposed.

17. *The beche-de-mer industry.*—During 1917–18, the following quantities of material were brought from the chank divers of Tirupalakudi :—

Large size (Nos. I and II qualities)	39,520
Small size (No. III quality)	19,407
	58,927

The former yielded as cured weight of 1,710 lb., the latter of 431 lb. or 2,141 lb. in all. The material cured to December 1917 was despatched to Singapore for sale and so far no intimation has been received as to its disposal. The second lot, which comprises the material cured in the second half of the season, remains on hand. The prices that will be obtained, it is afraid, may not be very satisfactory, especially in view of the fact that there is a heavy loss in exchange on remitting the proceeds to India. But these are war times and trade in this article suffers materially at present from difficulties of transport and from the unrest in China.

18. The actual cost of the raw material together with all charges amounted to Rs. 688–4–7, so that if we value the produce on hand at the rates obtained last year, the receipts on the operations will amount to Rs. 657–10–9. In view of the makeweight which the prosecution of this industry exercises upon the carrying on of the chank fishery, the small loss that may be sustained may be considered as an incidental and necessary expense of this latter fishery.

However with the return of normal conditions in the world, a considerable profit should then be earned.

19. A report upon the revival of this industry with full details of the methods of cure practised was issued as a constitutent report in Bulletin No. XI during the past year. A general review of the trade was appended. This publication should prove very useful to any one engaging in this industry and Mr. Alvain Scule, lately head of the Fisheries Department in the Philippine Islands, writes that he considers this report as one of the most valuable as well as one of the most interesting contributions to our knowledge of the trepang fisheries that has ever been written.

20. *Pearl fishery.*—Inspection has again been made of the banks off the Tinnevelly coast and again no pearl oysters. save a few scattered ones have been found. In addition a careful inspection of the ground outside of the chain of islands stretching from Pamban to Vaippar was made in November 1917 with the aid of the motor inspection schooner "Lady Nicholson." The result again was negative, no deposits of any kind being found. This same inspection was also useful in settling once for all, the question of whether there be any fishable beds of chanks sea ward of these islands. None were found. The ground generally is a rocky plateau with scanty life outside of sea-fans (Gorgonids), sea-whips (*Juncea*) and non-commercial sponges. Hence we may conclude that there is no possibility of extending the chank fishery to new grounds anywhere off the southern coast of the Rāmnād district.

21. The small bed of scattered pearl oysters, on the seaward eastern edge of the chank beds *north* of Rameswaram Island still survives and gives off its periodical sworms. Some of these appear to have settled on the Dhanushkodi jetties, as a number were found by the contractor when demolishing the South pier there. By the courtesy of the Port Officer, Pamban, these were forwarded to me for examination. They proved to be from nine months to 18 months of age, and some appear to have contained a few seed pearls.

22. The scheme to erect a pearl-culture laboratory on Krusadai Islands is still in abeyance in view of the heavy cost involved and the poor market at present for culture pearls. A modified scheme is under consideration.

23. *Tuticorin fish farm.*—The results during the past year are again an improvement upon previous years. The total expenditure consisted of Rs. 684-6-7 made up as follows :—

	RS.	A.	P.
Wages	566	9	1
Nets and sundries	117	13	6
	684	6	7

while the receipts amounted to Rs. 1,496-7-0 as against Rs. 925-13-9 in the preceding year. The net profit for the period under report deducting supervision and depreciation charges comes to Rs. 614-0-5. The catches and respective sales consisted of—

	RS.	A.	P.
9,052 lb. prawns	932	2	9
4,718 lb. fish	239	14	3
Rental for crab fishery	48	0	0
Miscellaneous	276	6	0
Total ...	1,496	7	0

As in 1916-17, the bulk of the prawns were sold to line fishermen, who greatly appreciate the advantage of getting regular supplies of bait.

24. The long delayed completion of the sluices and weir is expected at the end of next month; thereafter the running of this lagoon as a real fish-farm will begin. The present and past satisfactory results have been attained in spite of great difficulties, which the provision of sluices should largely decrease, to the additional financial profit of the undertaking.

25. *Pulicat oyster park.*—The collection of spat and the supply of cultivated oysters have now become established routine. There is nothing special to chronicle for the past year save that appreciation of their quality and of the care taken in cultivation under hygienic conditions has resulted in a considerable extension of sales, whereby the small loss in 1916-17 upon working has been further reduced. The financial aspect is shown as follows :—

	1917-18 (14 months).			1916-17 (12 months).		
	RS.	A.	P.	RS.	A.	P.
Expenditure	1,124	5	9	805	10	0
Receipts	843	6	6	459	9	6
Loss ...	280	15	3	346	0	6

The expenditure consisted of wages Rs. 377, freight Rs. 337-1-3, miscellaneous charges Rs. 410-4-6.

26. *Zoological specimen supply.*—This phase of our activities has continued to expand and the sales of specimens, sent out at little over cost price, to educational institutions throughout India aggregate Rs. 736 for the past year as against Rs. 576 in 1916-17. The disabilities mentioned in last year's report continue to retard progress.

27. A large range of specimens including both museum and dissection specimens in alcohol and formalin, and educational type collections of shell fish and crustaceans, were exhibited at the second Madras Exhibition

held at the end of 1917. The type collections have been specially in demand for schools and were it convenient to supply larger numbers, there would be little difficulty in finding purchasers. It is quite clear that as zoological teaching and nature study extend in India, an increasing demand is springing up for specimens such as this department has begun to supply. Colleges in the north India continue to furnish the bulk of orders and it would seem that students in the north have greater aptitude and preference for zoology than those of the south.

28. *Research.*—During the past year Bulletin No. XI was published. The following marine reports appeared therein, viz.:—

I. The Edible Molluscs of the Madras Presidency.

II. A new protozoan cause of widespread mortality among marine fishes.

III. A statistical analysis of the Fishing Industry of Tuticorin.

IV. The Indian beche-de-mer industry; its history and recent revival.

29. These four papers totalled an aggregate of 150 pages of letterpress and were illustrated with 38 original text figures. An investigation of Indian boat designs, viewed both from the present day aspect and from the wider standpoint of the ethnologist, has been completed, and will probably be published by the Asiatic Society of Bengal as one of their memoirs. A summary of the facts and a statement of the main conclusion were read before the Ethnological section of the Indian Science Congress in January of the present year. The outstanding deduction is contained in the theory, based largely on widespread similarities in boat construction and corroborated by certain affinities of physical characters among the chief fisher caste of the extreme south, that there is a strong infusion of Polynesian blood in the coast population of certain southern and western districts in India.

30. Investigations relating to the migrations of sardines, surface drift in the Gulf of Mannar, the biological survey of Siluvathurai lagoon, now turned in a fish-farm, and the details of the varied fishing methods employed on the coast of India, engaged attention during the year and it is hoped to publish some of the results at an early date. So far as possible the aim is kept in view of putting upon permanent record all important facts which are ascertained from time to time. One of the most regrettable occurrence of life in India, is the frequent loss of valuable data through the postponement or neglect of publication. The inevitable consequence is waste of valuable time in succeeding years, when other inquirers have again to traverse unnecessarily the whole ground in the absence of satisfactory records.

31. *Deputation to Baroda.*—Consequent upon the request of the Government of Baroda for the loan of my services to make a second investigation of the fishery resources of their State, with the sanction of the Madras Government, I spent one month from 9th December 1917 in Kathiawar. I found that the steps taken by the Baroda Government to develop their pearl fishery on the lines of the recommendations I drew up ten years ago, had resulted satisfactorily in providing a new source of livelihood to some hundreds of the poorer coast population and in adding considerably to the local revenue. The stow-net fishery for Bombay Ducks carried on in large deep-sea fishing boats of 10 to 20 tons burden as well found and roomy as many British herring boats was investigated, together with other phases of the local fishing industry. A report has been furnished, embodying a number of recommendations for further development. It was gratifying to find that the two Baroda fishery officers are men who had been trained (as far as facilities permitted) by the Madras Fisheries Department; both are doing most useful work and promise to become valuable technical officers.

32. *Socio-economic work.*—I am glad to report that three co-operative societies were formed among the fishermen of Ramnad district during the past year, two in Rameswaram Island and the other at Karangadu. It is too early to say how far they will prove successful, as the men are by nature improvident and averse to regular repayment of money obtained on loan. Much depends locally upon the success of these pioneer societies and everything is being done to assist the management. Many of the members are divers who participate in the Rameswaram fishery and as this has given good returns this season, the men are in an unusually good position to take up shares. No better year could have been chosen for the inception of this work.

33. *Loans for the purchase of boats.*—As borrowers cannot be made to see the necessity for regular repayment, however small be the monthly rate agreed upon, loans have been restricted to a minimum. At the present time there are five outstanding amounts, which represent as many boats bought with Government assistance. All loans have been substantially reduced during the season although payments have been irregular as mentioned above. No amounts have become unrecoverable, and no losses are probable as the balances of the loans made are amply secured upon the boats purchased, which stand in the name of the Superintendent, Pearl and Chank Fisheries, as representing Government, pending the extinction of the advances.

The actual amounts outstanding on 31st May 1917 totalled Rs. 340 owed by 6 men; on the same date this year the amount was Rs. 363 owed by 5 men.

34. *Temperance work* of a practical nature has again been carried on among the Tuticorin divers in the shape of a coffee stall intended to counter the attractions of the toddy shop. Coffee and country cakes are supplied at cost price and again I have to report gratifying success. Similarly at Rameswaram, arrangements were made with two shop-keepers to open coffee stalls in the camp; sites were given them free and I am glad to say that the divers, whose conduct and behaviour appreciably improved, welcomed this step. The stalls did a thriving trade as the men's earnings were usually sufficient to permit them to indulge in the luxury of a cup of tea or coffee. It is worth noting that tea appears to be rapidly ousting coffee in these men's estimation. I believe that simple practical methods such as this, conjoined with a scheme for the education of the village boys in the real things that matter in life, hold out great promise in the problem of bettering the condition and outlook of our fishing population.

35. *Recruitment for the Overseas Forces.*—I am glad to be able to record that this section has contributed its share to the forces being recruited for service abroad. Mr. W. Stopford, Engineer of the "Lady Nicholson," and Raman, his assistant, have been both joined the motor mechanic service in East Africa; I trust they may be found useful members of the force and return safely with such added experience as may qualify them for higher employment than their old posts. This office has also canvassed extensively the fishermen of this coast with a view to obtain recruits for the Labour Force in Mesopotamia and several men have thereby been induced to join. So far as possible the progress of the war and the justice of our cause have been explained to the divers from time to time. Our small staff has also contributed to the War Loan as far as it was able, the result being an investment of Rs. 2,186.

36. I am glad to report that the staff in general worked with marked zeal and ability. I desire to take this opportunity both to bring this to the notice of Government and to thank the officers themselves for their loyal co-operation in carrying on the work of the marine section of this department; the hours of duty are often of necessity very protracted during the continuance of the chank fishery, while the conditions of life at out-stations on the Ramnad coast and when camping in the islands off Tuticorin, are disagreeable and trying; little notice can be paid to "official holidays" during the busy season.

(2)

Report of work done in the Piscicultural branch during the year ending 30th June 1918.

Owing to the lamented death of Mr. H. C. Wilson on the 11th of April 1917, Mr. B. Sundara Raj, Assistant to the Piscicultural Expert, took

charge of the branch till 7th February 1918, when as a tentative measure I was appointed as the Piscicultural Expert and Mr. B. Sundara Raj as the Assistant Director.

Staff.—Excepting certain minor changes there was no change in the staff during the year.

Tours.—Mr. B. Sundara Raj visited the following districts on tours of inspection and investigation :—

The Kurnool district in June 1917, the Nellore district in July, October and November, January and February, the Chingleput district in May and June 1917 and April and May 1918, the Tanjore district in August and September, the Nilgiris in April and May 1917 and South Kanara (with myself) in April and May 1918.

In South Kanara the four sites for fish farms selected by Mr. H. C. Wilson were inspected with a view to follow up his proposals for the improvement of the fisheries of the district.

The Sub-Assistant and two Assistant Inspectors toured in the districts of Kurnool, Bellary, Anantapur, Cuddapah, Chittoor and Chingleput in connexion with the tank investigation scheme.

Regarding the various operations in hand the Assistant Director reports as follows :—

" *Sunkesula fish farm.*—The work of the farm continued to be satisfactory. A notable feature was the successful breeding of the highly esteemed species *Etroplus suratensis* by providing artificial nests made of Cuddapah slabs. The fish deposit their adhesive eggs on the under surface of these slabs and are asciduous in the care of their eggs and young. Experiments during the previous two years failed apparently for want of such facilities. The Kurnool-Cuddapah canal and tanks in the neighbourhood could now be stocked with the fry which was the main object of Mr. Wilson in introducing this valuable species from the Madras estuaries into Sunkesula.

" *Pudur scheme.*—The Public Works Department are doubtful of successfully impounding water in the Mudupanchala cheruvu, the largest of the three tanks covered by the scheme. The Executive Engineer, Kurnool, is still investigating the matter.

" Meanwhile the gourami have begun to breed and in the absence of extensive rearing grounds (which the Pudur scheme was intended to provide) the fry had to be transported to Ippur.

" *Live-fish market.*—The live-fish market at Kurnool which was closed in 1915 after the first year of its work owing to difficulties in management was reopened for the sale of fish from July to January—a season when fish is scarce in Kurnool—and was run this time by a contractor who was

supplied with 884 lb. murrel and other fish for Rs. 101–4–6 from the Sunkesula fish farm. The sales would have been a greater success had it not been for the virulent outbreaks of plague. Two ponds for storing the fish in Kurnool town are under construction.

" *Nallamalais scheme.*—The two ponds and quarters at Praema have been completed and the ponds were stocked with a selection of larvicides from the Ippur farm for breeding purposes. As these ponds are insufficient, another site near Mahanandi for additional ponds has been selected and the plans and estimate for them have been prepared.

" *Colair scheme.*—The scheme for a floating hatchery and the improvement of the Colair lake fishery is still pending owing to the presence of fixed engines. The Collector has been requested to take action in the matter.

" *Cuddapah anti-malarial scheme.*—The 9 miles of road up to Pallamadugu has been repaired but the new jungle road from thence to Peddagadi is being laid.

" *Ippur fish farm.*—The work of this new farm progressed well during the year. It holds a large head of gourami and larvicides and is the main source of supply, at present, of larvicides to the public and local bodies in the Presidency. The growing demand for larvicides has necessitated the utilization of the whole Ippur Kamini tank for the cultivation of these fish. The food fish reared simultaneously in the tank are being departmentally fished and marketed.

" *Red Hills scheme.*—A suitable site for fry ponds and staff quarters has not yet been secured. The matter is still under correspondence.

" *Powder factory scheme.*—The gourami introduced from Java and Mauritius two years ago bred for the first time last December. Many permanent water tanks of the Presidency operated by the department continued to be stocked with the acclimatized species *Etroplus suratensis* from this farm.

" Owing to the isolated situation of two of the ponds some *Etroplus* were stolen from one of them, but precautions have been taken to prevent the recurrence of such thefts.

" *Chingleput scheme.*—A scheme to combat malaria in the Reformatory School at Chingleput by draining the moat into the adjoining river by means of a channel costing Rs. 12,590 was drawn up by the authorities of the Reformatory School. Subsequently an anti-malarial *cum* piscicultural scheme costing only Rs. 7,500 proposed by this department was sanctioned by Government. The latter scheme while preventing the spread of malaria by stocking the moat with larvicidal fish will enable the water of

the moat to be used for the rearing of valuable food fish. The work has been taken in hand by the Public Works Department.

"*Hilsa hatchery.*—Owing to the failure of seasonal floods in the Coleroon, the Hilsa fishery was almost a failure. Only four solitary ripe fish (females) were secured. The eggs though few were sufficient to verify the results of the previous year's investigations and to furnish further data of scientific value.

"*Nilgiri fishery.*—I visited the Avalanche hatchery and inspected some of the trout streams on the plateau in April 1917. Trout fingerlings were transferred from the fry ponds to the streams as usual. This fishery and the conservancy of the Bhavani and Moyar have since been entirely managed by the District officers and the question of its future control is pending before Government.

"*Acclimatization and introduction of exotic and indigenous species—Gourami.*—The two consignments of gourami from Java and Mauritius which are kept in the Powder Factory and Sunkesula farms bred during the year. Some 200 of the resultant fry from both these farms have been transferred to specially prepared ponds at Ippur where they are rapidly growing—fry which were only $\frac{1}{2}''$ or $\frac{3}{4}''$ in December have grown to 6″ within the last five months.

"*Tench and English carp.*—As stated in last year's report these fish have not yet bred though they have grown well during the last four years in Sunkesula.

"As regards indigenous species, a number of estuarine food fish in addition to *Etroplus suratensis* are being acclimatized to fresh water at the Ippur and Powder Factory farms for introduction into inland waters. One of the largest and esteemed local carp *Catla catla*, which is non-indigenous to waters south of the Kistna, is being introduced into a series of tanks in the south.

"*Stocking of tanks and channel.*—As in the previous year the Kurnool-Cuddapah canal and the permanent water tanks in the districts of Kurnool, Cuddapah, Bellary, Salem, Chingleput and North Arcot were stocked with fish from the Sunkesula and Powder Factory farms.

"As desired by Government in their Memorandum No. 19-A/17-2, Revenue, dated 22nd March 1917, a preliminary survey of all suitable tanks of the Presidency was undertaken and nine districts (Kurnool, Nellore, Cuddapah, Bellary, Anantapur, Chittoor, North Arcot, Chingleput and Tanjore) have been covered. A scheme for dealing with the tanks in three contiguous districts (Nellore, Chingleput and North Arcot) with proposals for additional fish farms at suitable centres is under preparation. The remaining districts will be taken up in due course.

"*Fishery rentals.*—The fisheries of the Cauvery-Coleroon fetched Rs. 21,886 in excess of the compensation payable to the five district boards concerned for the year 1917–18. The compensation payable to the District Board of Tanjore was reduced from Rs. 26,620 to Rs. 23,031 and in consequence a sum of Rs. 14,356 for 1914–15 to 1917–18 was resumed from the district board funds (vide G.O. No. 4073, Revenue, dated 15th December 1917). The rentals from tanks and channels operated by the departments showed an increase of Rs. 23,691 over the compensation paid to the local bodies.

"*Larvicidal operations.*—Considerable progress was made during the year in organizing and developing the work of breeding and distributing larvicidal fish to the public and to local bodies. 83,500 fish were sold for Rs. 835 to municipal and local bodies and military authorities with full instructions for stocking their waters and in some cases their men were trained in such operations. A leaflet of instructions entitled 'The value of fish as natural enemies of mosquitoes in combating malaria' was published and some 150 copies have already been distributed to the purchasers of larvicidal fish.

"At the request of local bodies and the Sanitary Commissioner, officers of the department conducted anti-malarial inspection of wells and tanks in the municipalities of Bellary, Negapatam and the Vriddhachalam union. Owing to the shortage of trained hands, it has not been found possible to depute officers for this work in all cases, and some of the local bodies and Native States have been requested to send their own men to Madras for training. This is advantageous to the parties concerned as they will have a trained man always on the spot, while the cost of deputing a man for training is the same as that of obtaining the services of this department officers. The Madras Corporation stocked a number of wells with fish in 1915, but in a number of cases the fish introduced had disappeared. In response to a request of the Malaria Board received through Government the matter was investigated and a complete report was submitted to Government. The investigations in Madras and in other places go to prove that the failure of larvicidal operations conducted by local bodies without reference to this department is chiefly due to the procuring of unsuitable larvicides locally. The ignorant fishermen who are entrusted with this work are incapable of selecting the proper varieties of fish and very frequently introduce unwittingly the fry of predaceous kinds. Moreover such stocking deprives the waters in the neighbourhood from which the fish are obtained, of their own natural stock of larvicides. Hence it was urged that the only way out of the difficulty is for the local

bodies to obtain advice from this department and supply of fish from the fish farms.

"As desired by Government a register has been maintained in which the supply of larvicides is being recorded and the Sanitary Commissioner is furnished with particulars of such supplies in each case.

"*Deputation to Hyderabad.*—Government in G.O. Mis. No. 4030 of 13th December 1917 sanctioned my deputation to Hyderabad in May or June 1918 for a second inspection of the Oosman Sagar tank. Owing to pressure of other urgent work it has not been found possible to undertake the inspection this year."

Experimental deep-water fishing.—One of the great drawbacks in tank fishing is the inability of the local fishermen to capture fish except when a tank is about to dry up, due to their primitive methods and implements. This is a source of loss both to the fishermen and to the consumer, inasmuch as the fishermen do not realize the full value of their catches owing to an abundance of fish placed in the market and the consumer is deprived of fresh fish throughout the major part of the year and at times the whole year if the tank does not dry up. Moreover a tank that is not regularly fished does not yield the maximum weight of fish. Government tanks that fail to dry up in any year therefore fetch very little or no rentals. With a view to remedy those evils experiments were initiated in some of the large irrigation tanks near Madras to devise methods and implements to fish tanks throughout the year.

V. Govindan,
Piscicultural Expert, Government Fisheries.

ANNEXURES.

Statement I showing summary of charges and receipts of the Fishery Department, 1917–18.

Particulars.	Charges.			Receipts.			Difference.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
I. Supervision and research.	59,100	9	1	274	8	0	−58,826	1	1
II. Marine fisheries	69,167	12	11	1,01,577	0	6	+32,409	3	7
III. Inland fisheries	56,122	6	4	69,573	12	6	+13,451	6	2
IV-A. Factories	23,902	14	8	51,051	9	2	+27,148	10	6
IV-B. Vessels	9,815	14	1	3,753	4	3	−6,062	9	10
V. Capital expenditure—10 per cent thereon ...	1,939	14	1	Nil.			−1,939	14	1
	2,20,049	7	2	2,26,230	2	5	+6,180	11	3

STATEMENT I (*a*) showing details for "Expenditure" in Statement I.

Particulars.	Capital expenditure	Charges—Running expenditure.					
		Salaries.	Establishment.	Allowances.	Supplies and services	Contingencies.	Total.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
I. Supervision and research.	407 14 0	20,567 7 10	16,982 1 8	11,527 1 6	1,843 10 3	8,180 3 10	59,100 9 1
II. Marine fisheries.	1,819 8 5	8,148 6 2	10,416 4 11	2,473 13 11	46,638 14 3	1,490 5 8	69,167 12 11
III. Inland fisheries.	1,448 2 9	1,394 9 5	1,176 7 2	Nil.	53,551 5 9	Nil.	56,122 6 4
IV-A. Factories— (1) Cannery ..	7,312 1 4	Nil.	3,445 10 6	562 8 0	9,013 9 3	Nil.	13,021 11 9
(2) Tanur ..	589 10 11	Nil.	2,373 9 10	562 8 0	7,945 1 1	Nil.	10,881 2 11
IV-B. Vessels ...	7,821 7 5	Nil.	4,056 7 8	132 6 6	5,626 15 11	Nil.	9,815 14 1
V. Capital expenditure—10 per cent on the above	19,398 12 10	...	...	...	...	...	1,939 14 1
	1,939 14 1	30,110 7 5	38,450 9 9	15,258 5 11	1,24,619 8 6	9,670 9 6	2,20,049 7 2

Details for II Marine Fisheries.

Supplies and services.

	RS. A. P.	RS. A. P.
A. Chank fisheries—		
(1) Ramnad fisheries ...	*29,244 5 7	
(2) Other fisheries	12,274 11 5	
		41,519 1 0
B. Pearl fisheries—		
(1) Examination of pearl banks	486 11 3	
(2) Pearl fisheries running expenses	294 8 6	
		781 3 9
C. Vessels—		
(1) Lady Nicholson ...	790 9 4	
(2) Sutherland	666 6 2	
(3) Pearl	412 3 1	
		2,169 2 7
D. Other work—		
(1) Pulicat oyster farm ...	868 7 6	
(2) Marine fish farm ...	612 10 10	
(3) Beche-de-mer	618 4 7	
		2,169 6 11
Total ...		46,638 14 3

* Includes a sum of Rs. 4,000 being the fifth year's proportion of the total consideration paid in 1913-14 for a fifteen years' lease of the Ramnad Chank Fisheries.

Details for III. Inland Fisheries.

Supplies and services.

	RS.	A.	P.	RS.	A.	P.
A. Tank stocking—						
(*a*) Compensation to district boards	44,946	14	0			
(*b*) Tank stocking	464	12	5			
				45,411	10	5
B. Other work—						
Sunkesula fish farm	3,841	3	9			
Hilsa hatchery and lower anicut	210	3	6			
Ippur fish farm	1,715	13	7			
Powder factory charges ...	611	6	5			
Nallamalais	537	13	3			
Investigation of new schemes.	333	8	6			
House boat maintenance ...	308	5	5			
Motor boat expenses ...	481	4	11			
				8,139	11	4
				53,551	5	9

Details for IV-B. Vessels.

Supplies and services.

Turbinella	1,868	12	11			
Fishing canoes	3,096	8	6			
Leverett	292	15	6			
Machwas	368	11	0			
				5,626	15	11
				5,626	15	11

STATEMENT I (*b*) *showing details for "Receipts" in Statement I.*

Details for II. Marine Fisheries.

(*a*) Receipts from all chank fisheries, including beche-de-mer fisheries, as per statement III	98,173	9	0
(*b*) Receipts from sale of zoological specimens and other miscellaneous receipts ...	822	13	5
(*c*) Receipts from marine fish farm	1,588	3	7
(*d*) Receipts from oyster culture at Pulicat ...	992	6	6
	1,01,577	0	6

Details for III. Inland Fisheries.

	RS.	A.	P.
(*a*) Rentals from tanks and rivers, etc., the fisheries of which were taken over by this department (vide Statement II)	68,637	8	0
(*b*) Receipts from sale of fish larvicides ...	835	0	0
(*c*) Other miscellaneous receipts	101	4	6
	69,573	12	6

Details for IV-A. Factories.

(1) Cannery—			
(*a*) Actual receipts (amount remitted into treasury) from sale of canned, etc., fish.	31,548	4	3
(*b*) Amount outstanding on 1st July 1918 but since realized	1,854	2	7
(*c*) Value of manufactured goods at hand on 1st July 1918.	7,020	10	6
	40,423	1	4
(2) Tanur—			
(*a*) Actual receipts (amount remitted to treasury from sale of cured, etc., fish). ...	8,019	4	10
(*b*) Amount outstanding on 1st July 1918 since realized	1,724	3	5
(*c*) Value of goods on hand on 1st July 1918.	884	15	7
	10,628	7	10

Details for IV-B. Vessels.

(*a*) Receipts from fishing canoes	3,171	10	9
(*b*) Turbinella	55	8	0
(*c*) Ratnagiri Machwas	526	1	6
	3,753	4	3

NOTE.—The sum of Rs. 274-8-0 noted as receipts against "I. Supervision and Research" represents the amount of rent realized from the Fisheries Bungalow at Ennur.

STATEMENT II.—Statement showing the names of tanks or tank system, canal or canal system, and rivers, the amount of compensation paid and amount of rentals realized for 1917–18.

Name.	Compensation paid. RS. A. P.	Rentals realized. RS. A. P.	Reference to Government Orders taking the fisheries.
Cauvery and Coleroon ...	34,898 0 0	56,784 2 0	G.Os. Nos. 1797, Revenue, dated 20th June 1914; 711, Revenue, dated 8th March 1917; and 1886, Revenue, dated August 1916.
Kurnool-Cuddapah canal...	2,553 14 0	1,165 0 0	G.O. No. 3660, Revenue, dated 12th December 1913.
Dusimamandur and Kaveripakkam tanks.	3,789 0 0	4,685 0 0	G.O No. 856, Revenue, dated 21st March 1917.
Chembarambakkam and Madurantakam tanks.	2,195 0 0	3,950 0 0	Do.
Singanamalla tank ...	117 0 0	...	Do.
Gudur and Karedu tanks ...	185 0 0	250 0 0	Do.
Rangasamudram and other tanks.	200 0 0	12 8 0	Do.
Kamalapuram tank ...	500 0 0	860 0 0	G.O. No. 1686, Revenue, dated 22nd July 1916.
Daroji tank...	155 0 0	270 0 0	G.O. No. 2330, Revenue, dated 31st July 1911.
Barur and connected tanks.	120 0 0	166 0 0	G.Os. Nos. 2720, Revenue, dated 9th September 1912; and 953, Revenue, dated 30th March 1914.
Penukondapuram tank ...	118 0 0	141 0 0	G.O. No. 3016, Revenue, dated 13th October 1913.
Badaikhan tank ... ... } Belegal tank ... ... }	16 0 0	66 0 0	G.O. No. 610, Revenue, dated 16th March 1916.
Markapur tank	95 0 0	219 4 0	G.O. No. 3016, Revenue, dated 13th October 1913.
Venkatapuram tank ...	...	42 8 0	G.O. No. 100 L., dated 20th February 1914.
Kocheruvu	...	20 0 0	Do.
Ippur, Kamini and Pudu-parti tanks.	5 0 0	6 2 0	G.O. No. 495, Revenue, dated 23rd February 1915.
Total ...	44,946 14 0	68,637 8 0	

STATEMENT III.—Summary of expenditure and receipts of all chank and Beche-de-mer fisheries, season 1917-18.

Expenditure.

	RS.	A.	P.
Expenditure incurred in conducting the Tinnevelly chank fishery	8,962	5	9
Expenditure incurred in conducting the Ceylon chank fishery	3,029	5	5
Expenditure incurred in conducting the Rāmnād chank fishery	23,835	13	6
Expenditure incurred in conducting the Sivaganga chank fishery	246	13	6
Expenditure incurred in conducting the Beche-de-mer fishery	977	6	1
Fifth year's proportion of the total consideration paid in 1913–14 for a fifteen years' lease of the Ramnad chank fishery	4,000	0	0
Total expenditure ...	41,051	12	3
Balance being net profit on the season's operations	57,121	12	9
	98,173	9	0

Receipts.

	RS.	A.	P.
Value of chank and other receipts from Tinnevelly chank fishery	15,866	15	8
Value of chank and other receipts from Ramnad chank fishery	70,411	10	11
Value of chank and other receipts from Ceylon chank fishery	4,577	6	3
Value of chank and other receipts from Sivaganga chank fishery	269	13	5
Estimated value of 2,141 lb. of beche-de-mer on hand	657	10	9
Rent for the Tanjore chank fishery	4,890	0	0
" South Arcot chank fishery ...	900	0	0
" Chingleput and Nellore chank fishery	600	0	0
	98,173	9	0

Statement IV.—Trading account for the year ended 30th June 1918—Government Fisheries Cannery, Chaliyam.

	RS. A. P.	RS. A. P.		RS. A. P.	RS. A. P.
To stock of canned goods on 1st April 1917	9,762 2 0		By sale of canned fish remitted to treasury from 1st April 1917 to 30th June 1918 ...	30,908 8 2	
To stock of cured fish on 1st April 1917	4 10 6		By sale of cured fish.	132 15 1	
To stock of oil and guano on 1st April 1917	200 2 0		,, guano ...	115 4 0	
Pit manure on 1st April 1917 ...	13 12 0		,, fried oil ...	250 2 0	
Fried oil	127 8 0		,, fish oil ..	94 2 0	
Tins manufactured at the cannery on 1st April 1917 ...	1,229 8 2	11,337 10 8	,, prawn shells ...	33 12 0	
			,, miscellaneous products.	13 9 0	31,548 4 3
To cost of solder, tin plate, empty cans (imported), tin, rosin, soldering fluid, turpentine, varnish, etc. ...	6,971 15 0		By value of canned, etc., fish sold but not realized and remitted to treasury on 30th June 1918	1,854 2 7	1,854 2 7
To cost of fuel (firewood, coal, kerosene oil, petrol and other oils) ...	655 14 0		By value of manufactured goods on hand on 1st July 1918—		
To cost of fish used for canning and curing, etc. ...	1,839 8 9		Guano	130 0 0	
			Fried oil ...	66 14 0	
			Prawn shells ...	1 8 0	
			Pit manure ...	23 0 0	
Fish condiments including oil for packing	1,702 7 0		Canned fish ...	6,407 3 0	
Cost of sundry stores, such as soda ash, cotton waste, spirit, vaseline, etc. ...	136 15 6		Miscellaneous. products	2 14 9	6,631 7 9
Salt and preservatives	100 13 0		Empty cans manufactured in the cannery	...	389 2 9
Packing materials, such as packing cases, baskets, brown, etc., papers, twine and straw and wire nails used.	651 11 0				
Labels and rubber rings for tins ...	400 3 0				
Manufacturing wages—wages of temporary staff and extra labour ...	2,273 15 7				
Railway freight ...	1,518 2 9				
Petty coolie and carriage	494 13 10	16,746 7 5			
Gross profit (transferred to profit and loss account) ...	...	12,338 15 3			
		40,423 1 4			40,423 1 4

GOVERNMENT FISHERIES CANNERY, CHALIYAM.

Profit and loss account for 1917–18.

	RS.	A.	P.		RS.	A.	P.
To rent of Bangalore stall	46	8	0	By gross profit transferred from trading account	12,338	15	3
To fixed travelling allowance of Sir F. A. Nicholson (12½ per cent only debited)	562	8	0				
To pay of permanent staff (50 per cent only debited) ...	1,171	10	11				
To service stamps ...	603	0	0				
To advertising and printing charges ...	188	8	6				
To depreciation and interest at 10 per cent	1,616	0	0				
To net profit ...	8,150	11	10				
	12,338	15	3		12,338	15	3

Statement V.—Trading account for the year ended 30th June 1918
Government Fisheries Yard, Tanur.

	RS. A. P.	RS. A. P.		RS. A. P.	RS. A. P.
To stock of cured fish on 1st April 1917.	1,099 2 2		By sale of cured fish remitted to treasury on 1st April 1917 to 30th June 1918.	5,453 14 7	
To stock of fish oil and foots on 1st April 1917 ...	370 1 1		By sale of fish guano.	969 12 1	
To stock of guano on 1st April 1917 ...	11 4 0		By sale of fish oil and foots	420 15 0	
To stock of miscellaneous products on 1st April 1917 ...	43 15 4	1,524 6 7	By sale of prawn shells	75 5 2	
To cost of fish used for curing operations	3,332 3 2		By sale of pit manure.	86 2 9	
To cost of oil and guano curing operations	431 9 5		Miscellaneous receipts	1,013 3 3	8,019 4 10
To cost of salt and preservatives ...	129 11 3		By value of goods sold but not realized and remitted to treasury on 30th June 1918	1,724 3 5	1,724 3 5
To cost of sundry stores used ...	237 8 2		By value of manufactured goods on hand on 1st July 1918—		
To cost of fuel, such as firewood, kerosene oil, etc. ..	226 14 0		Cured fish ...	284 3 11	
Packing materials ...	380 12 9		Fish guano ...	296 10 10	
Wages of temporary staff and of coolies.	1,371 11 8		Fish oil and foots	210 1 7	
Railway freight on parcels of cured fish.	748 1 3		Prawn shells ...	50 3 3	
Petty coolie and carriage	820 11 6		Pit manure ...	43 12 0	884 15 7
Watering and manuring charges for coconut plants ...	95 4 2				
Cost of fish oil purchased	675 0 0	7,837 7 4			
To gross profit (transferred to profit and loss account) ...	...	1,266 9 11			
		10,628 7 10			10,628 7 10

MARINE BIOLOGICAL LABORATORY WOODS HOLE

GOVERNMENT FISHERIES—STATION, TANUR.

Profit and loss account for 1917-18.

	RS.	A.	P.		RS.	A.	P.
To rent of Bangalore stall	90	0	0	By gross profit transferred from trading account	1,266	9	11
To rent of Cannanore yard	72	11	0	By net loss	997	1	3
To fixed travelling allowance of Sir F. A. Nicholson (12½ per cent debited) ...	562	3	0				
To pay of permanent staff (50 per cent debited)	978	8	2				
To service stamps ...	350	0	0				
To depreciation on plant, machinery, shed, etc., 2,000 — 200 + 300 = 2,100 at 10 per cent	210	0	0				
	2,263	11	2		2,263	11	2

Note.—A sum of Rs. 1,412 was received within the year (25th June 1918) on account of the supply of oil to the Munitions Board in view of the expenditure by the West Coast station, Tanur branch, in salaries, travelling allowance and contingencies. This was not included in the receipts; it converts the loss on Tanur into a small profit.

Order—No. 3461, Revenue, dated 17th October 1918.

Miscellaneous

The Fisheries department continued to do good work throughout the year in the development of the industries entrusted to its care. The report does not deal with the soap experiments as the soap factory is no longer under the control of this department.

2. The Pisciculturist's branch made progress under the charge of Mr. Sundara Raj. The proposals for the utilization of the Mopad Reservoir for piscicultural operations and those for the cultural and sanitary development of the Vellore Fort Moat are under the consideration of the Government. The cannery operations were extended to some extent and the net profits were considerably greater but the scale of operations is still insufficient to meet the general demand. It is satisfactory to note that a scheme for the refrigeration of fish has been elaborated and will be put into immediate operation. The effect of the absence of freight on the oil and guano operations has been to some extent counterbalanced by demands from the Military department and the jute mills and by the formation of groups of producers acting as intermediaries for large customers. The Government note that these groups will be formed into co-operative societies and will thus be further consolidated.

3. The Honorary Director has submitted preliminary proposals regarding inshore fishing experiments in Madras. He has shown that the experiments already conducted were a success from a fishery point of view, though financially they resulted in a small loss on account of the cost of bringing boats and men from the West Coast and of inducing the men to remain at Madras. The Government have just sanctioned the Honorary Director's proposals for continuing the experiments on a larger scale and for a longer period.

4. The department is continuing its philanthropic work in the social and economic development of the fisherfolk and the fact that Mr. Govindan is being invited by them to visit the villages and organize societies is a tribute to the success of his work. The Government are glad to receive the assurance of Sir Frederick Nicholson that the people themselves are beginning to understand the need for education and it is hoped that the proposals approved in G.O. No. 2048, Revenue, dated 27th May 1918, will have far-reaching developments.

5. The war has rendered it impossible to proceed with the work of the Krusadai pearl oyster farm, the Marine Aquarium at Madras, and deep sea exploration. Proposals are however under consideration for the establishment of the Krusadai farm on a smaller scale.

6. A trial chank fishery expedition to Ceylon was a successful feature of the year and with the sanction of the Government of India the experiment is being repeated.

7. The Government are glad to note that the department was awarded a gold medal and the diploma of excellence for canned and the cured fish at the Madras Exhibition of Industries in 1917–18 and that people of other provinces are taking an interest in the work of the department.

8. The Government agree that the primary object of the department is not revenue but development and progress. It is nevertheless satisfactory to observe that the working of the department during the year shows a small profit.

(True extract)

M. YOUNG,
Additional Temporary Secretary to Government.

Editors' Table.

LIST OF MADRAS FISHERIES BULLETINS ISSUED UP TO DATE WITH THEIR CONTENTS AND PRICES.

BULL. NO. — PAGES

1. PAPERS FROM 1899 RELATING CHIEFLY TO THE DEVELOPMENT OF THE MADRAS FISHERIES BUREAU. BY SIR F. A. NICHOLSON, 1915, Re. 1-14-0. (Pages 237.)

2. NOTE ON FISHERIES IN JAPAN. BY SIR F. A. NICHOLSON, 1907. (Out of print.)

3. THE PRESERVATION AND CURING OF FISH. BY SIR F. A. NICHOLSON, 1909. (Reprint edition.)

4. MADRAS FISHERY INVESTIGATIONS, 1908. BY JAMES HORNELL. (Out of print.)

5. THE PRACTICE OF OYSTER-CULTURE AT ARCACHON AND ITS LESSONS FOR INDIA. BY JAMES HORNELL, 1910, Re. 1-6-0—
   - I. Introduction ... 1—4
   - II. The physical conditions characterizing Arcachon basin ... 4—7
   - III. The origin and development of oyster-culture at Arcachon ... 7—19
   - IV. Present methods and conditions ... 19—74
   - V. Principal characteristics of other European systems of cultivation ... 75—79
   - VI. Applicability of French methods to oyster-culture in India ... 79—90

6. MARINE FISH-FARMING FOR INDIA. BY JAMES HORNELL, 1911, Re. 1-4-0—
   - I. Introductory ... 1—3
   - II. French fish-farming at Arcachon ... 4—20
   - III. The communal fish-farms of Comacchio ... 21—62
   - IV. The scope for marine fish-farming in India ... 63—83

7. THE SACRED CHANK OF INDIA. BY JAMES HORNELL, 1914, Rs. 2—
   - Introductory ... 1—2
   - I. The chank fisheries of India and Ceylon ... 3—40
   - II. The chank bangle industry ... 41—116
   - III. The role played by the chank in Indian religion and life ... 117—172
   - IV. Appendix ... 173—181

8. MARINE FISHERY INVESTIGATIONS IN MADRAS, 1914-15. BY JAMES HORNELL, 1916, Re. 1-12-0—
   - I. A note on the edible oyster ... 1—10
   - II. An explanation of the irregularly cyclic character of the pearl fisheries of the Gulf of Mannar ... 11—22
   - III. Notes upon two exploring cruises in search of trawl grounds off the Indian and Ceylon coasts ... 23—41
   - IV. Report on the pearl fishery held at Tondi, 1914 ... 43—92
   - V. Professor Huxley and the Ceylon pearl fishery, with a note on the forced or cultural production of free spherical pearls. 93—104
   - VI. The utilization of coral and shells for lime-burning in the Madras Presidency ... 105—126

9. FISHERY STATISTICS AND INFORMATION, WEST AND EAST COASTS, MADRAS PRESIDENCY. COMPILED BY V. GOVINDAN, WITH INTRODUCTION BY SIR F. A. NICHOLSON, 1916, Re. 1-12-0—
   Gives a summary of the numbers of fish-curing yards and fishing boats, the methods of curing fish and a sketch of the economic conditions now existing, etc. (Pages 140.)

10. ANNUAL REPORTS OF THE FISHERIES DEPARTMENT FOR EACH YEAR FROM 1908-09 TO 1916-17. BY SIR F. A. NICHOLSON, Re. 1-10-0. (Pages 179.)

11. MADRAS FISHERY INVESTIGATIONS, 1917, Re. 1-4-0—
   - I. The edible molluscs of the Madras Presidency. BY JAMES HORNELL ... 1—51
   - II. A new protozoan cause of widespread mortality among marine fishes. BY JAMES HORNELL ... 53—66
   - III. A statistical analysis of the fishing industry of Tuticorin (South India). BY JAMES HORNELL ... 67—117
   - IV. The Indian beche-de-mer industry: its history and recent revival. BY JAMES HORNELL ... 119—150
   - V. Carp-growing in Germany. BY SIR F. A. NICHOLSON ... 151—160
   - VI. Note on treatment of swamps, stream beds, ponds, wells, pools, and other mosquito-infested areas for the destruction of their larvae. BY H. C. WILSON ... 161—172
   - VII. Madras Fisheries Administration Report, 1917-18. BY SIR F. A. NICHOLSON, As. 8 ... 173—207

12. MADRAS FISHERY INVESTIGATIONS, 1920, Rs. 4—
   - I. Madras Fisheries Administration Report, 1918-19. BY JAMES HORNELL, As. 5 ... 1—42
   - II. The Outrigger Canoes of Indonesia. BY JAMES HORNELL. Illustrated with 55 text figures and 16 plates, Rs. 2-14-0 ... 43—114
   - III. A Statistical Analysis of an Inshore Fishing Experiment at Madras, 1919. BY M. RAMASWAMI NAYUDU, As. 4 ... 115—133

MBL/WHOI LIBRARY
WH 18Y3 9

BULL. NO.		PAGES
	IV. Reports on the methods of capture and supply of fish in the rivers of the Nilgiri district. By the late H. C. Wilson, As. 4.	135—156
	V. Notes on the Cichlid Fishes of Malabar, Etroplus suratensis and E. maculatus. By N. P. Panikkar, As. 4	157—166
13.	Madras Fishery Investigations, 1921—	
	I. Madras Fisheries Administration Report, 1919-20. By the Hon. Mr. A. Y. G. Campbell, As. 4	1—34
	II. Remarks on Canning. By Sir F. A. Nicholson, As. 12 ...	35—146
	III. Manufacture of Fish Oil and Guano. By Sir F. A. Nicholson, Re. 1-4-0	147—266
14.	IV. The Fisheries of Norway and Denmark. By James Hornell, As. 8	1—56
	V. The Madras Marine Aquarium. By James Hornell, As. 6 ...	57—96
	VI. The Common Molluscs of South India. By James Hornell, Re. 1	97—215
15.	Fishery Reports, 1922—	
	I. Madras Fisheries Administration Report, 1920-21. By James Hornell, As. 4	1—44
	II. Notes on the Fauna and Fishing Industries of the Laccadive Islands. By S. Ramaswami Ayyangar, As. 4	45—69
	III. The Grey Mullets of Tuticorin. By R. H. Whitehouse, As. 4	71—98
	IV. The Flying-fish Fishery of the Coromandel Coast and the Spawning Habits of Cypsilurus. By J. Hornell, with a note on the Eggs and early Embryonic Development. By M. Ramaswami Nayudu, As. 6	99—112
	V. The Aims and Achievements of the Madras Department of Fisheries. By J. Hornell, As. 3	113—129
	VI. A Statistical Account of the Fish Supply of Madras. By S. T. Moses, As. 6	131—166
16.	The Indian Pearl Fisheries of the Gulf of Mannar and Palk Bay. By J. Hornell, Rs. 2-8-0	1—188
17.	Fishery Reports, 1923—	
	I. Madras Fisheries Administration Report, 1921-22. By J. Hornell, As. 4	1—44
	II. A new Copepod Parasite from the Gills of Wallago Attu. By B. Sundara Raj, As. 2	45—48
	III. Report on Young Fishes, etc. By R. H. Whitehouse, Re. 1-4-0	49—103
	IV. Anatomy of the Chank. By S. T. Moses, As. 5	105—127
	V. A Contribution to the Life-History of the Indian Sardine. By J. Hornell and M. Ramaswami Nayudu, As. 14 ...	129—197
	VI. Inspection Report, Madras Pearl Banks, 1923. By J. Hornell, As. 3	199—214
18.	Fishery Reports, 1924—	
	I. Madras Fisheries Administration Report, 1922-23. By James Hornell, As. 10	1—58
	II. The Fishing Methods of the Madras Presidency, Part I—The Coromandel Coast. By James Hornell, As. 12	59—110
19.	Fishery Reports, 1925—	
	I. Madras Fisheries Administration Report, 1923-24. By B. Sundara Raj, As. 12	1—58
20.	Fishery Reports, 1926—	
	I. Madras Fisheries Administration Report, 1924-25. By B. Sundara Raj, As. 14	1—78
21.	Fishery Reports, 1927—	
	I. Madras Fisheries Administration Report, 1925-26. By B. Sundara Raj, Rs. 2-4-0	1—94
22.	Fishery Reports, 1928—	
	I. Madras Fisheries Administration Report, 1926-27. By B. Sundara Raj, Re. 1	1—99
	II Fish Statistics for 1925-26 (Supplement to the Administration Report for 1926-27). By B. Sundara Raj, As. 14	1—76
23.	Fishery Reports, 1929—	
	I. Madras Fisheries Administration Report, 1927-28. By Dr. F. H. Gravely, As. 14	1—86
	II. Fish Statistics for 1926-27 (Supplement to the Administration Report for 1927-28). By B. Sundara Raj, As. 10	87—151
	III. Report on a systematic survey of deep-sea fishing grounds by S.T. "Lady Goschen," 1927-28. By Sundara Raj, Re. 1-8-0 ...	153—187
24.	Fishery Reports, 1930—	
	I. Madras Fisheries Administration Report, 1928-29. By B. Sundara Raj, Re. 1-4-0	1—103
25.	Fishery Reports, 1931—	
	I. Madras Fisheries Administration Report, 1929-30. By B. Sundara Raj, As. 14	1—104